USGS

WATER RESOURCES RESEARCH GRANT PROPOSAL

Title: Description and Interpretation of Salinization in the Lower Arkansas River Valley, Colorado Focus

Categories: WQL, GW, AG

Keywords: Salinity, Saline soils, Drainage, Water quality, Groundwater quality, Data analysis, Data storage and retrieval Duration: 3/99 - 2/00 (With extension to be requested for two to three additional years)

Federal funds: 16,895

Non-federal funds: Direct: 18,991 Indirect: 14,799 Total: $50,685

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Congressional district: 4th

Statement of critical regional or state water problems

Salinity and drainage problems usually appear in intensively-irrigated alluvial valleys within a few decades to a few hundred years of the commencement of large-scale irrigation. Sooner or later, the artificially high rate of application of water to land exceeds the natural rate of drainage, the water table rises, and artificial drainage is needed to regain an acceptable water and salt balance (Gates and Grismer 1989). In the lower Arkansas river valley in Colorado, saline high water tables began to appear in the early part of the twentieth century. Installation of subsurface drains in the 1930s seemed to assuage the problems for awhile (USDA-NRCS, Rocky Ford Field Office, personal communication). However, water tables began to rise again in the late 1970s. Watts and Lindner-Lundsford (1992) suggested that the blame be placed on increased diversions from the river for irrigation application and associated reduction in groundwater pumping. Indeed, in the 1950-70's, two reservoirs began operations that have drastically changed the river. Flushing from floods was substantially reduced and controlled releases were made from the reservoirs. This allowed year-round, or at least prolonged, supplies of water to the canals on the perimeter of the valley. Seepage from these canals and lower velocity in the river have caused the river channel to widen, sediments to deposit on the bed, and the river level to rise. Recent investigations by the principal investigators of water levels in the reach of the Arkansas River upstream of John Martin Reservoir

indicate an increasing trend since about 1989. The overall rise in the river level (of about 0.6 m) may have significantly reduced the gradient that drives drainage flows from the irrigated land to the river. Since 1991, irrigation water supplies from snow pack and rainfall have been far above average. Many of the large supply canals in the area have diverted more water in each of the last three years than in their 100+ year histories and have increased seepage throughout the basin. Also, in response to the recent Kansas-Colorado court ruling, groundwater pumping in the valley, which serves to reduce water table levels, has diminished.

These factors contribute to a growing body of evidence that the irrigated lands of the lower Arkansas are subjected to forces that are elevating the severity of waterlogging and salinization. At a time when conjecture about the main causes and prognosis of the problems is growing, some people feel that conditions already have reached a crisis stage. Informal and anecdotal evidence abounds: salt crusting on soil surfaces, seepage and wet spots in selected fields, stunted growth of crops, and reduced crop yields. Such losses threaten the economic wellbeing of the rural communities in the Valley and, by extension, diminish the agricultural base of the state. Until recently, however, scientific investigations of the problems have been sparse. Furthermore, studies often are limited in their scopes and piecemeal in their approaches, failing to provide a coherent understanding of the extent and severity of the problems.

Statement of results or benefits

There is an acute need to place the diagnosis of salinity and waterlogging problems in the Arkansas Valley on a sound scientific footing. Furthermore, beyond the need to accurately describe the problems for farmers and for state and regional agencies, a reliable database will be needed to aid in prescribing solutions. This project proposes to strengthen the data foundation needed to characterize salinization problems in the lower Arkansas river valley and to guide the search for answers. The output will be a report that assesses the scope and severity of the problems. The report will consider soil salinity, water table depth and salinity; river level, flow, and salinity; water levels, flows, and salinity in canals and drains; irrigation practices; hydraulic conductivity of surface soils; well pumping; and crop yields. Plausible causes and promising directions for addressing the problems also will be addressed. The report will be accompanied by a digital spatially-referenced (ArcViewTM GIS format) database.

The results of the proposed project should prove a valuable resource in support of decision-making and intervention in the Valley. Without sound and timely intervention, it appears that the Valley will eventually succumb, at least in a large part, to the ill effects of salinization. Solutions based upon accurate knowledge of field conditions will be needed to insure sustainability of the Valley's productive agricultural base and preservation of its rural communities.